

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.

THIS PAGE BLANK (usr:tu)

# (12) UK Patent Application (19) GB (11) 2 200 775 (13) A

(43) Application published 10 Aug 1988

(21) Application No 8701970

(22) Date of filing 29 Jan 1987

(71) Applicant  
International Pipeline Products Limited  
(Incorporated in United Kingdom)

Walkerville Industrial Estate, Catterick Garrison,  
North Yorkshire, DL9 4RR

(72) Inventor  
Kenneth Samuel Hemingway

(74) Agent and/or Address for Service  
Urquhart-Dykes & Lord  
5th Floor, Tower House, Merrion Way, Leeds,  
West Yorkshire, LS2 8PA

(51) INT CL<sup>4</sup>  
G08B 5/00

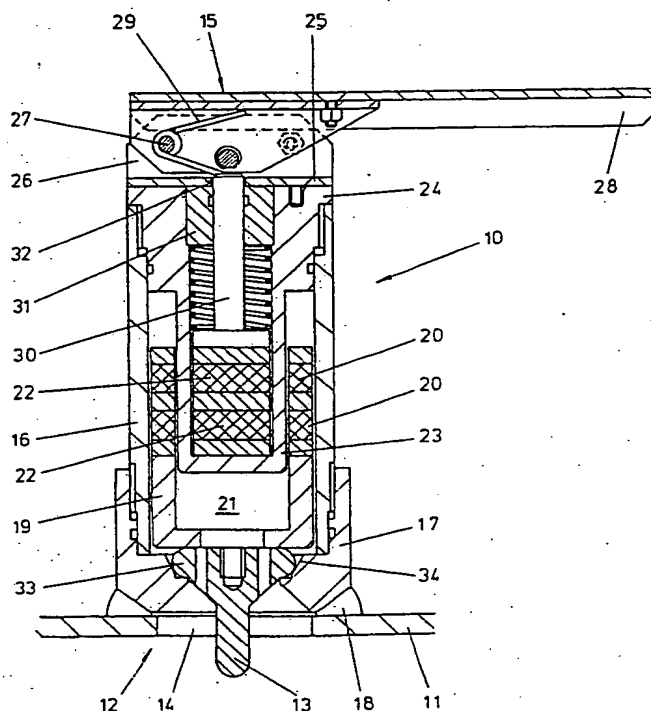
(52) Domestic classification (Edition J):  
G4F AB  
U1S 1573 1882 G4F

(56) Documents cited  
GB 1407815

(58) Field of search  
G4F  
Selected US specifications from IPC sub-class  
G08B

## (54) Actuator for pipeline signalling device

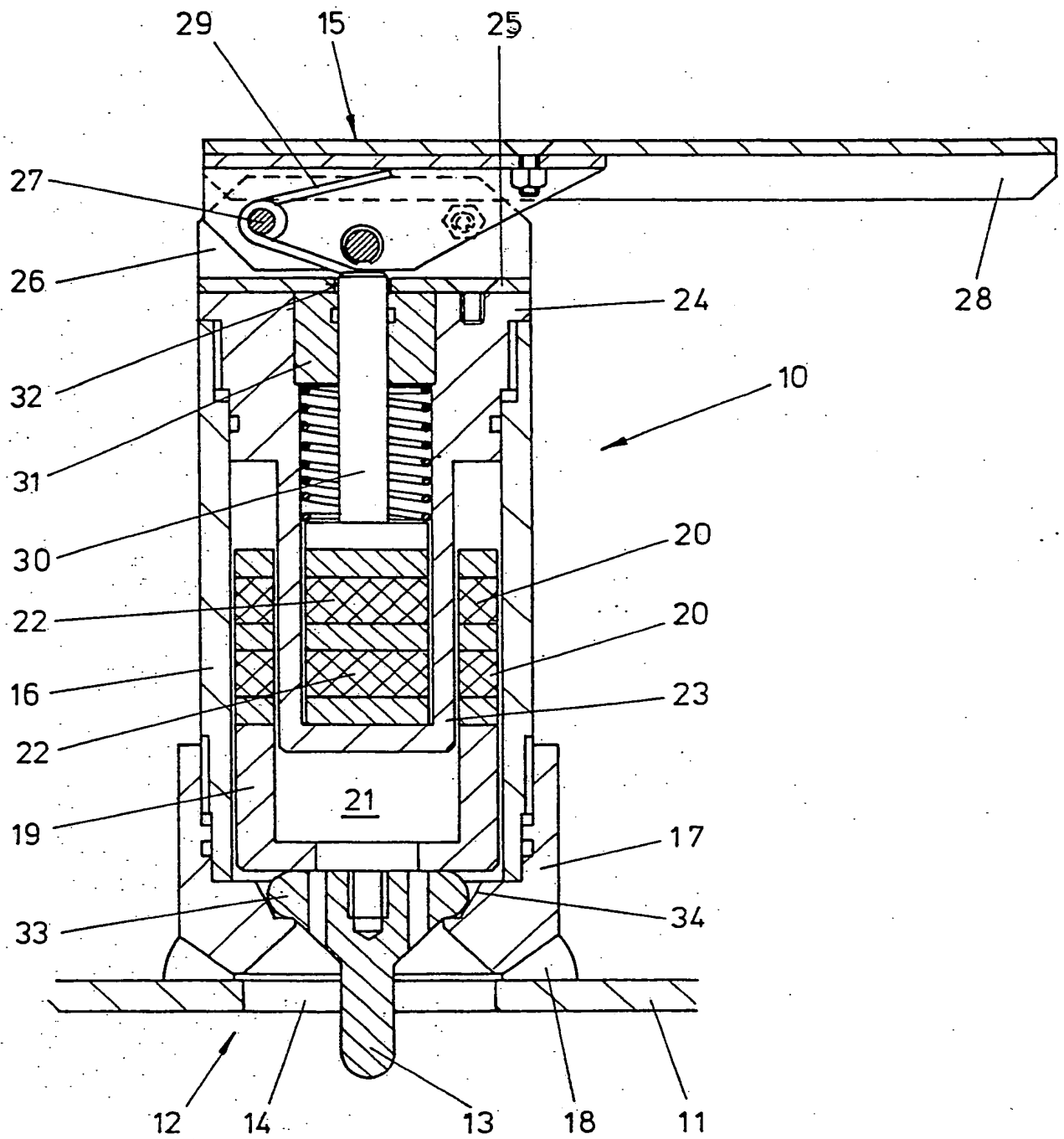
(57) An actuator 10 mounted on a wall of a pipeline 11 has a trigger 13 which extends through a hole 14 in the wall of the pipeline 11 so as to lie in the path of a "pig" moving along the pipeline, and is magnetically coupled with a signalling device 15 to effect operation thereof upon engagement of the trigger 13 by the pig. The actuator comprises a housing 16, a follower 19 slidable in the housing, a first magnetic component 20 provided on the follower 19, and a second magnetic component 22 arranged in an internal space 21 defined in the follower 19, the second component being movable along this space from an inoperative position to an operative position by magnetic attraction with the first component 20 during movement of the latter to its operative position whereby the second component effects on operation of the signalling device 15.



The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25 (1) of the Patents Rules 1982.

UDC 62-73



## ACTUATOR FOR PIPELINE SIGNALLING DEVICE

This invention relates to an actuator which is adapted to be mounted on a pipeline and which has a trigger intended in use to extend through a hole in the wall of the pipeline so as to lie in the path of a "pig" or other device moving along the pipeline, the actuator being coupled with a signalling device and arranged to effect operation of the signalling device upon engagement of the trigger by the pig.

Pipeline signalling devices are known as "pig signallers", and are used to monitor the safe passage of a pig along a pipeline. A pig may comprise a device, such as a ball, which moves at the head of a particular charge of liquid or gas along a pipeline, or separates two different charges, and operation of signalling devices arranged at desired monitoring points along the pipeline provide an indication of safe passage of the pig, and of the charge which follows it.

Other types of pig comprise scrapers or cleaners which are moved along pipelines in order to remove undesired deposits, and clearly it is desirable to learn of the safe passage of the pig along the pipeline or, in the event of an interruption to the movement of the pig, to be able to determine the particular length of pipeline in which the pig is located.

The trigger for a pig signaller projects radially inwardly of the wall of the pipeline, and is displaced, usually by a pivotal type movement by the pig, so as to permit the continued passage of the pig along the pipeline, and this displacement of the trigger is transmitted to the actuator which, in turn, causes operation of the signalling device.

There are many existing designs of actuator, and most of these are purely mechanical devices which transmit the

displacement of the trigger as a mechanical actuating force to operate, or to trigger the operation of the signalling device.

The invention is concerned with a magnetic type  
5 actuator which does not rely upon a direct mechanical linkage between the trigger and the signalling device through the actuator, but which has cooperating magnetic or magnetisable components which effect transmission of the trigger action to the signalling device.

10 The use of these components is of considerable advantage, over known purely mechanical actuators, in that pipeline pressure is transferred into the body of pig signallers, and there can be particular sealing problems with mechanical actuators. By contrast, with cooperating  
15 magnetic components, there is no direct mechanical connection between the components, with consequent avoidance of sealing problems which would otherwise be present.

According to the invention there is provided an  
20 actuator which is adapted to be mounted on a pipeline and which has a trigger intended in use to extend through a hole in the wall of the pipeline so as to lie in the path of a pig or other device moving along the pipeline, and a signalling device coupled with the actuator and operable  
25 thereby to effect indication of safe passage of the pig along the pipeline, in which the actuator comprises:

a housing adapted for securement at a monitoring station provided on a pipeline;

a follower slidably mounted in the housing and movable  
30 from an inoperative position to an operative position under the action of the trigger following displacement of the latter by a pig travelling along the pipeline, the follower being arranged to define a space therein;

a first magnetic or magnetisable component provided on  
35 the follower; and,

a second magnetic or magnetisable component arranged in said space and movable along said space from an inoperative position to an operative position by magnetic attraction with the first component during movement of the latter to its operative position, the second component having an actuator element which effects operation of the signalling device upon movement of the second component to its operative position.

The housing may comprise a generally cylindrical body which is secured to the monitoring station on the pipeline through the intermediary of a mounting bracket welded to the pipeline around the hole through which the trigger extends, and the signalling device may be mounted on one end of the cylindrical body. The signalling device may take any convenient form, such as a pivotally mounted "flag" which is latched in a non-signalling position, but which can be operated, or triggered into operation by the actuator element. Conveniently, a biasing arrangement, such as a torsion spring, may be provided at the mounting of the signalling device on the cylindrical body, to initiate rapid movement of the flag to a signalling position upon actuation by the actuator element.

The follower is slidable within the cylindrical body so as to carry out linear movement in response to displacement of the trigger. The space defined by the follower accommodates the second component, and conveniently, a fixed inner housing is also arranged within this space between the first and second components, this inner housing forming a guide for the movement of the second component. The inner housing is made of non-magnetic material, such as non-magnetic stainless steel, and conveniently comprises a cylinder in which a magnetic pack is slidably mounted, to form the second component. The inner housing may be secured at an end of the outer housing or body remote from the mounting of the body on the

pipeline so as to form a rigid assembly therewith.

The first component provided on the follower also may comprise an arrangement of magnetic packs, conveniently in the form of a stack of annular magnets mounted in the wall  
5 of the cylindrical follower.

The actuator element provided on the second component may take the form of a plunger which is connected at one end to the second component, and which extends through one end of the actuator to engage with the signalling device.

10 One embodiment of actuator according to the invention will now be described in detail, by way of example only, with reference to the accompanying drawing which is a longitudinal sectional view of the actuator mounted at a monitoring station of a pipeline.

15 Referring now to the drawing, the actuator is designated generally by reference 10 and is mounted on a wall of a pipeline 11 at a monitoring station 12, the actuator having a trigger 13 which extends through a hole 14 in the wall of the pipeline 11 so as to lie in the path  
20 of a "pig" (not shown) or other device moving along the pipeline. The actuator 10 is coupled with a signalling device 15 and is arranged to effect operation of the signalling device upon engagement of the trigger 13 by the pig.

25 The actuator 10 comprises an external housing or body 16 which is mounted on the pipeline 11 through a mounting bracket 17 welded in position around the hole 14 by an annular weld bead 18. A follower 19 is slidably mounted in the outer housing 16 and is movable from an inoperative  
30 position, as shown in the drawing, to an operative position under the action of the trigger 13 following pivotal displacement of the latter by a pig travelling along the pipeline.

A first magnetic or magnetisable component is provided  
35 on the follower 19, and comprises an annular stack of



magnetic packs 20 mounted in the cylindrical wall of the follower 19. The follower 19 also defines a cylindrical internal space 21, and a second magnetic or magnetisable component is arranged in this space 21 for movement along the space from an inoperative position, as shown in the drawing, to an operative position by magnetic attraction with the first component during movement of the latter. The second component comprises magnetic packs 22, and these packs are guided for movement within a non-magnetic stainless steel inner housing 23 which is also arranged within the space 21.

The inner housing 23 forms a fixed part of the actuator, and has an enlarged cylindrical end 24 which is secured at one end of the cylindrical body 16. An end plate 25 is secured to the enlarged end 24, and the signalling device 15 has a mounting bracket 26 secured to the end plate 25, and on this it is pivotally mounted via a horizontal pivot 27. Means is provided (not shown in detail), to hold the flag 28 in the non-signalling position, as shown, and may comprise spring loaded pips. A torsion spring 29 applies biasing to urge the flag 28 to pivot to a vertical signalling position (not shown) about the pivot 27, upon release of the flag 28 by the holding means.

To trigger the flag 28 to move to its signalling position, an actuator element 30 is coupled with the second magnetic component 22, and takes the form of a plunger which extends from the magnetic packs from which the component 22 is built-up and through a wiper ring housing 31, and an aperture 32 in the end plate 25. Displacement of the plunger 30, following upward movement of the second component 22, causes the flag 28 to be triggered to its signalling position.

The illustrated arrangement of trigger 13 may take any convenient form, whereby the trigger is displaced in a

direction along the axis of the pipeline, by carrying out a generally pivotal movement. The construction and arrangement of the trigger 13 is not crucial to this invention, provided only that it is able to transmit linear motion to the follower 19. By way of example only, the trigger 13 may comprise a body having a circular base 33 which is seated in an annular seating 34, and which is therefore able to pivot in its seating 34, for either direction of movement of a pig along the pipeline. The trigger 13 may take any of the forms shown in more detail in the specification of GB patent application No 8616726.

The illustrated embodiment of signalling device 15 comprises a mechanically moving flag 28. However, it should be understood that many other types of signalling device may be provided, and coupled with the actuator 10 in such a way as to be operated, or triggered into operation so as to take up a signalling position. The signalling device 15 may also comprise an electrically operated trigger arrangement for causing remote operation of a signalling or warning device.

## CLAIMS

1. An actuator which is adapted to be mounted on a  
5 pipeline and which is adapted to be mounted on a pipeline  
and which has a trigger intended in use to extend through a  
hole in the wall of the pipeline so as to lie in the path  
of a pig or other device moving along the pipeline, and a  
signalling device coupled with the actuator and operable  
10 thereby to effect indication of safe passage of the pig  
along the pipeline, in which the actuator comprises:

a housing adapted for securement at a monitoring  
station provided on a pipeline;

a follower slidably mounted in the housing and  
15 movable from an inoperative position to an operative  
position under the action of the trigger following  
displacement of the latter by a pig travelling along the  
pipeline, the follower being arranged to define a space  
therein;

20 a first magnetic or magnetisable component  
provided on the follower; and,

a second magnetic or magnetisable component  
arranged in said space and movable along said space from an  
inoperable position to an operative position by magnetic  
25 attraction with the first component during movement of the  
latter to its operative position, the second component  
having an actuator element which effects operation of the  
signalling device upon movement of the second component to  
its operative position.

30 2. An actuator according to Claim 1, in which the  
housing comprises a generally cylindrical body which is  
securable to the monitoring station on the pipeline through  
the intermediary of a mounting bracket welded to the  
pipeline around the hole through which the trigger extends  
35 in use, and the signalling device is mounted on one end of

said cylindrical body.

3. An actuator according to Claim 1 or 2, in which the signalling device comprises a pivotally mounted flag which is latched in a non-signalling position, but which  
5 can be operated, or triggered into operation by the actuator element.

4. An actuator according to Claim 3, in which a biasing arrangement is provided at the mounting of the signalling device on the cylindrical body, to initiate  
10 rapid movement of the flag to a signalling position upon actuation by the actuator element.

5. An actuator according to any one of the preceding Claims, in which said space defined by the follower accommodates said second component.

15 6. An actuator according to Claim 5, in which a fixed inner housing is also arranged within said space between the first and second components, said inner housing forming a guide for the movement of said second component.

7. An actuator according to Claim 6, in which the  
20 inner housing is made of non-magnetic material, and comprises a cylinder in which a magnetic pack is slidably mounted, to form said second component.

8. An actuator according to Claim 6 or 7, in which said inner housing is secured at an end of the outer  
25 housing or body remote from the mounting of the body on the pipeline so as to form a rigid assembly therewith.

9. An actuator according to any one of the preceding Claims, in which said first component provided on the follower comprises an arrangement of magnetic packs, in the  
30 form of a stack of annular magnets mounted in the wall of the cylindrical follower.

10. An actuator according to any one of the preceding Claims, in which the actuator element provided on the second component takes the form of a plunger which is  
35 connected at one end to the second component, and which

extends through one end of the actuator to engage with the signalling device.

11. An actuator according to Claim 1 and substantially as herein before described with reference 5 to, and as shown in the accompanying drawing.

**THIS PAGE BLANK (USPTO)**